

THE WEATHER AND CIRCULATION OF MAY 1950<sup>1</sup>

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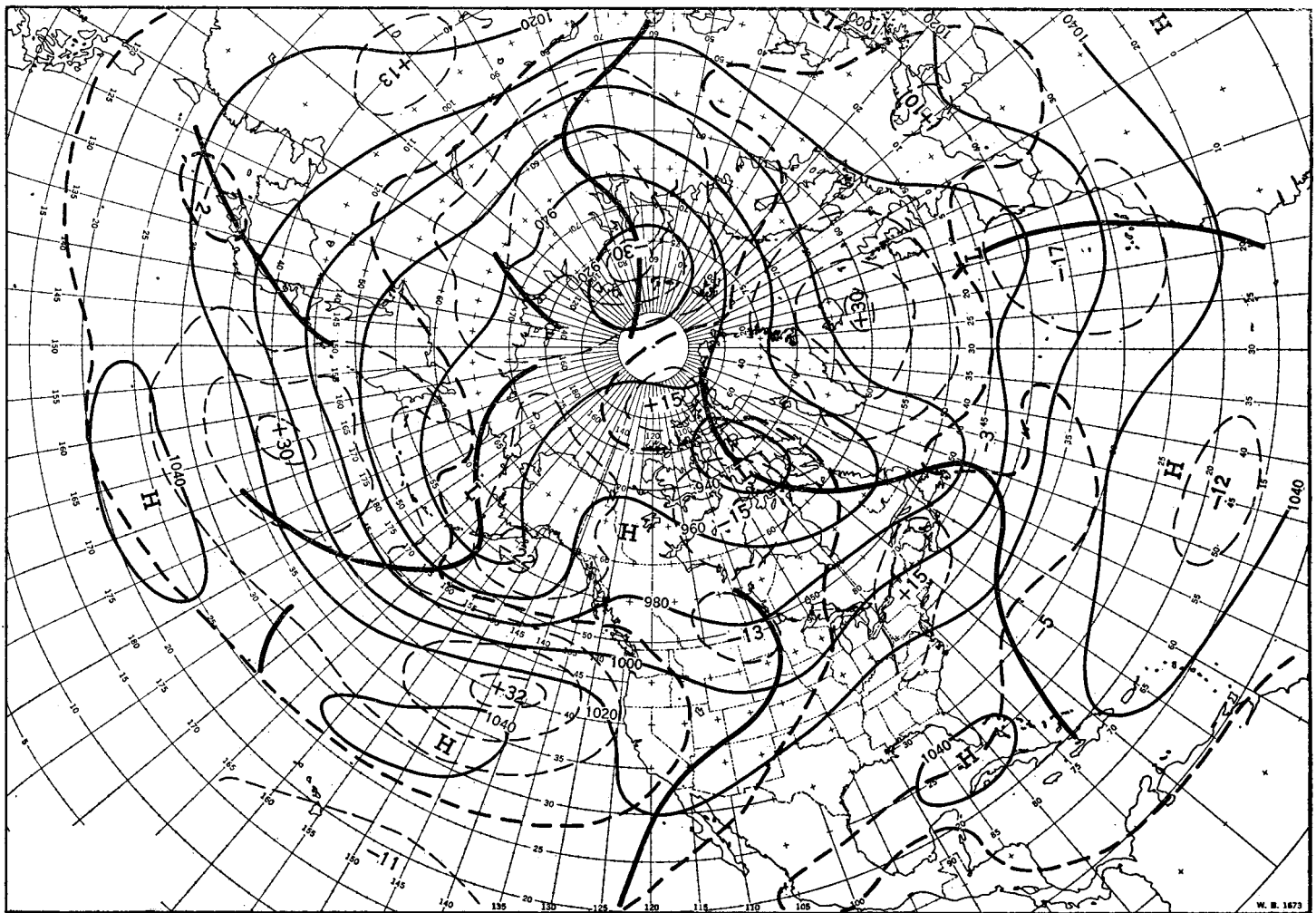
Washington, D. C.

The outstanding feature of the average circulation over North America and the adjacent oceans for May 1950 was the abnormal northeastward displacement of the east Pacific High and its extension as a ridge into western Canada (see fig. 1). A trough with below-normal heights extended from south central Canada through the southwestern United States, while a ridge with above-normal heights covered the east coast of the United States. The Low in northeast Canada was displaced southwest of its normal location for May, as shown by the field of 700-mb. height departures from normal. Although the trough

associated with this Low extended southeastward, into the western Atlantic, the minimum in the 700-mb. height anomaly field extended south-southwestward, connecting with the negative height anomalies in the Dakotas. This resulted in stronger-than-normal northwesterly flow into the region centered in Montana and Wyoming while the general area from Texas to Michigan experienced a stronger-than-normal southwesterly flow.

The westerlies in the eastern Pacific were located about 10° north of normal and were very well developed. This is indicated in figure 1 by the strong gradient of the 700-mb. height anomaly to the south of the Gulf of Alaska and was

<sup>1</sup> See Charts I–XI, following page 89, for analyzed climatological data for the month.



associated with the more northerly location of the east Pacific anticyclone. These circulation features had a pronounced effect on the track of cyclones in this region, as shown in Chart III. The west coast of the United States was mainly lacking in cyclonic activity entering from the Pacific, an abnormal circumstance for the month of May. The cyclone tracks were shifted northward into Canada, the storms moving eastward generally along the mean flow at the 700-mb. level and a well defined east-west trough of mean sea-level pressure. The anomaly of precipitation (Chart V insert) is a vivid portrayal of the lack of cyclones in the western United States, where a considerable deficiency of precipitation was observed. It is interesting to note that the anticyclone tracks (Chart II) show only one polar Pacific High entering North America, especially since the average conditions along and off the west coast were so predominantly anticyclonic with a nose of high pressure and positive anomaly protruding into the state of Washington at sea level. This can be explained by the fact that the anticyclone tracks which are presented represent the continuity of only closed circulations. During this month, several surges of high pressure entered the continent from the Pacific, but the continuity was obscured in western North America due to the absence of a closed circulation. The area of below-normal temperatures (Chart I) centered in northern Wyoming resulted from the frequent intrusion of fresh polar Pacific air into this region. This is also directly associated with some features of the 700-mb. (fig. 1) and sea-level (Chart VI) circulation. At both levels, the flow was more northerly than normal, and negative anomalies of both the 700-mb. height and sea-level pressure covered the region.

The thermal trough in Arizona and central California was quite well developed during the month, as shown by the sea-level isobars (Chart VI) and the sea-level temperature anomaly (Chart I). Drought conditions occurred in southern California, Arizona, and western New Mexico where little or no precipitation for the entire month caused earlier than normal irrigation. The more northerly flow relative to normal in much of this region at both sea level and aloft transported very dry air from the continent and prevented any supply of moisture from entering the area from its source region to the south. This lack of precipitation and cloudiness gave excellent conditions for warming in the interior and was associated with a well-developed sea breeze along the coastal regions of California. The existence of the sea breeze can best be seen from the wind rose at Los Angeles (Chart I). Its effect on the temperature anomaly (Chart I) as well as the percentage of clear skies (Chart IV) is quite pronounced along the coast. These three features go together with this type of regime, especially in the spring, when the water temperatures are much colder than the land during the day.

Excessive amounts of precipitation fell during the month in North Dakota and northern Minnesota, accompanying the mean trough and the center of negative 700-mb. height anomaly. This anomalous precipitation caused flood conditions over much of the region, the most publicized of which was the near disaster in Winnipeg which is located on the northward flowing Red River. Aggravating this flood condition was the melting of a snow cover which existed over much of the Red River watershed at the beginning of the month. Other less severe flood conditions occurred during the month in Arkansas and Oklahoma. The excessive precipitation in this region, mainly in the form of showers, was also associated with the trough in the southwestern United States. The stronger-than-normal southerly flow, both at sea level and aloft, transported considerable amounts of moisture from its source region in the Gulf of Mexico. Another related fact was the existence of strong cyclonic curvature of the sea-level isobars in the area (Chart VI). The precipitation spread eastward from Oklahoma with the flow aloft, along an east-west minimum in the sea-level pressure anomalies. The minimum was reflected in the sea-level isobars by the cyclonic curvature in the region of Tennessee. The deficient precipitation extending from northwestern Indiana along the northern border to Maine lay between the main cyclone track, well to the north, and the belt of showery precipitation to the south. Not a single cyclone entered this region during the month. A maximum in the sea-level pressure anomaly over this area was reflected in the sea-level isobars by predominant anticyclonic curvature. A stronger-than-normal ridge aloft also covers much of this region.

The below-normal surface temperatures centered in Wyoming (Chart I) gave way to above-normal temperatures to the east of the 700-mb. mean trough. Here the 700-mb. contours had only a slight component from the south, but the field of 700-mb. height anomaly shows that this flow had a stronger southerly component than normal. The above-normal temperatures in the eastern United States were also related to the above-normal 700-mb. heights. The belt of maximum above-normal temperatures was found in the region where the sum of the contributions from the above-normal heights and the stronger-than-normal southerly flow was greatest. This is mainly to the west of the maximum of positive height anomalies of the 700-mb. surface.

The existence of below-normal surface temperatures along the middle Atlantic coast of the United States might at first seem puzzling since it occurred very close to the region of maximum 700-mb. height anomaly. It is well known, however, that the weather of coastal regions is greatly influenced and modified by the adjacent oceans, especially in the spring when the ocean temperature lags that of the land. The easterly and northeasterly flows

indicated by the anomalies of the sea level pressure and 700-mb. height show that the air trajectories in this region were more predominantly maritime than normal. The frequent passage of anticyclones (Chart II) north of this region also is indicative of the frequency of easterly flow in this area. The association between persistent stratus conditions and the predominantly easterly regime of the type which occurred during this month is well known. The percentage of clear skies during the daytime as given in chart IV shows the deficiency of sunshine in this area. The region off the east coast between  $35^{\circ}$  and  $40^{\circ}$  N. was a frequent seat of cyclonic development (Chart III). The northeasterly flow relative to normal along and off the coast and the proximity of the polar anticyclone tracks were associated with the juxtaposition of cool polar maritime air and the warmer air over the Gulf Stream. A solenoidal field favorable to cyclonic development was established. These cyclones moved across the Atlantic mainly along the east-west sea level trough and the mean flow aloft. The main storm track across the Atlantic was

well to the south of normal due to the predominance of blocking conditions in the north Atlantic during the month (see fig. 1). As can be seen from the cyclone tracks (Chart III) the Lows were blocked completely from moving into the northeast Atlantic and some storms were even forced to recurve toward the west.

It is interesting to note that over many portions of the United States and adjacent oceans, the weather and circulation for May was a complete reversal from that of the preceding month (see fig. 1 of the article by Winston and Charts I and IV in the April 1950, Monthly Weather Review). In April the eastern half of the United States at the 700-mb. level was under the influence of a mean trough, cyclonic curvature, and below-normal heights, while the western half of the United States was under the influence of a mean ridge. The contrast in circulation patterns for the two months caused equally contrasting surface temperature and precipitation anomalies over the United States.



Chart I. Departure (°F.) of the Mean Temperature from the Normal, and Wind Roses for Selected Stations, May 1950

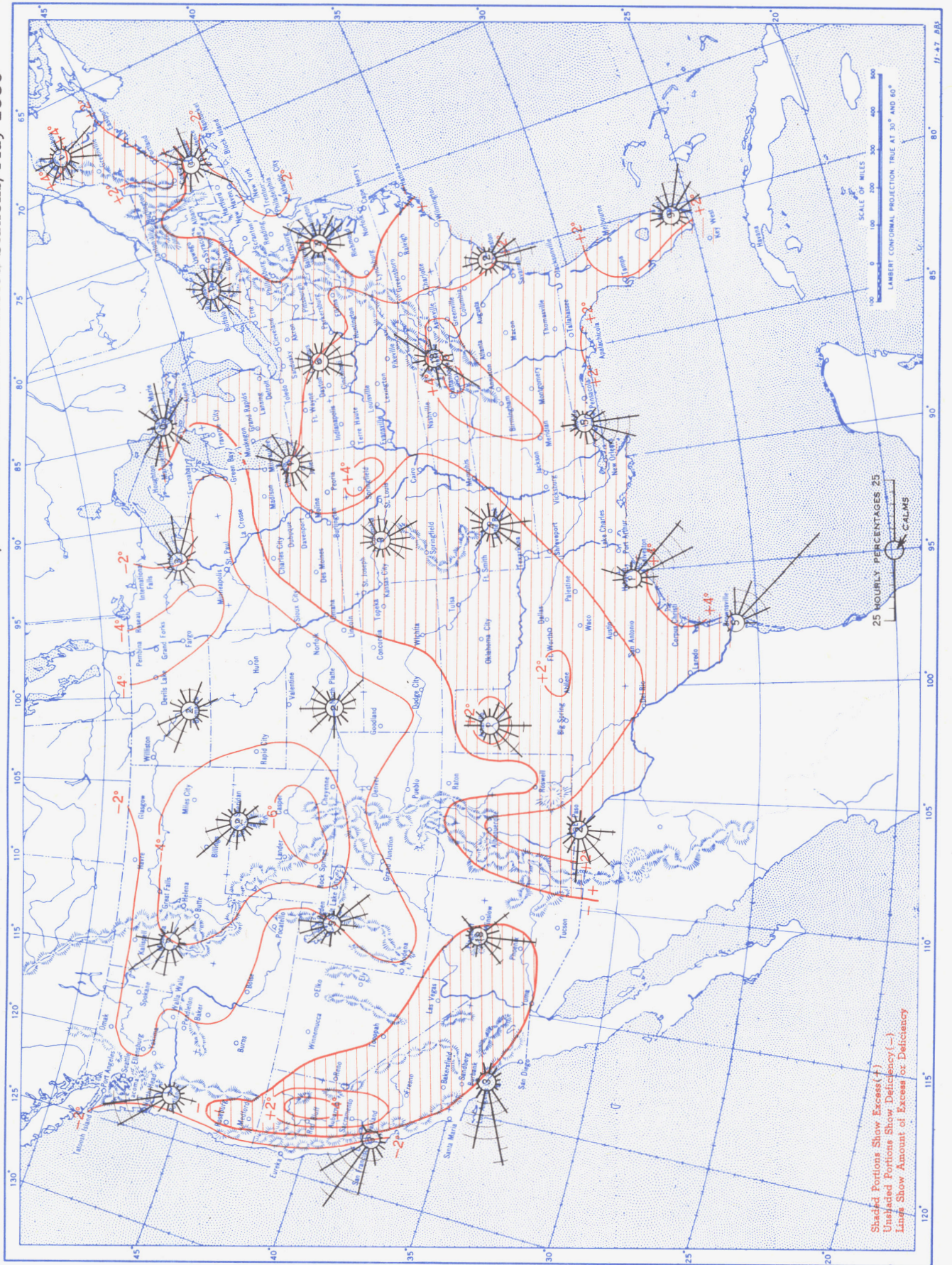
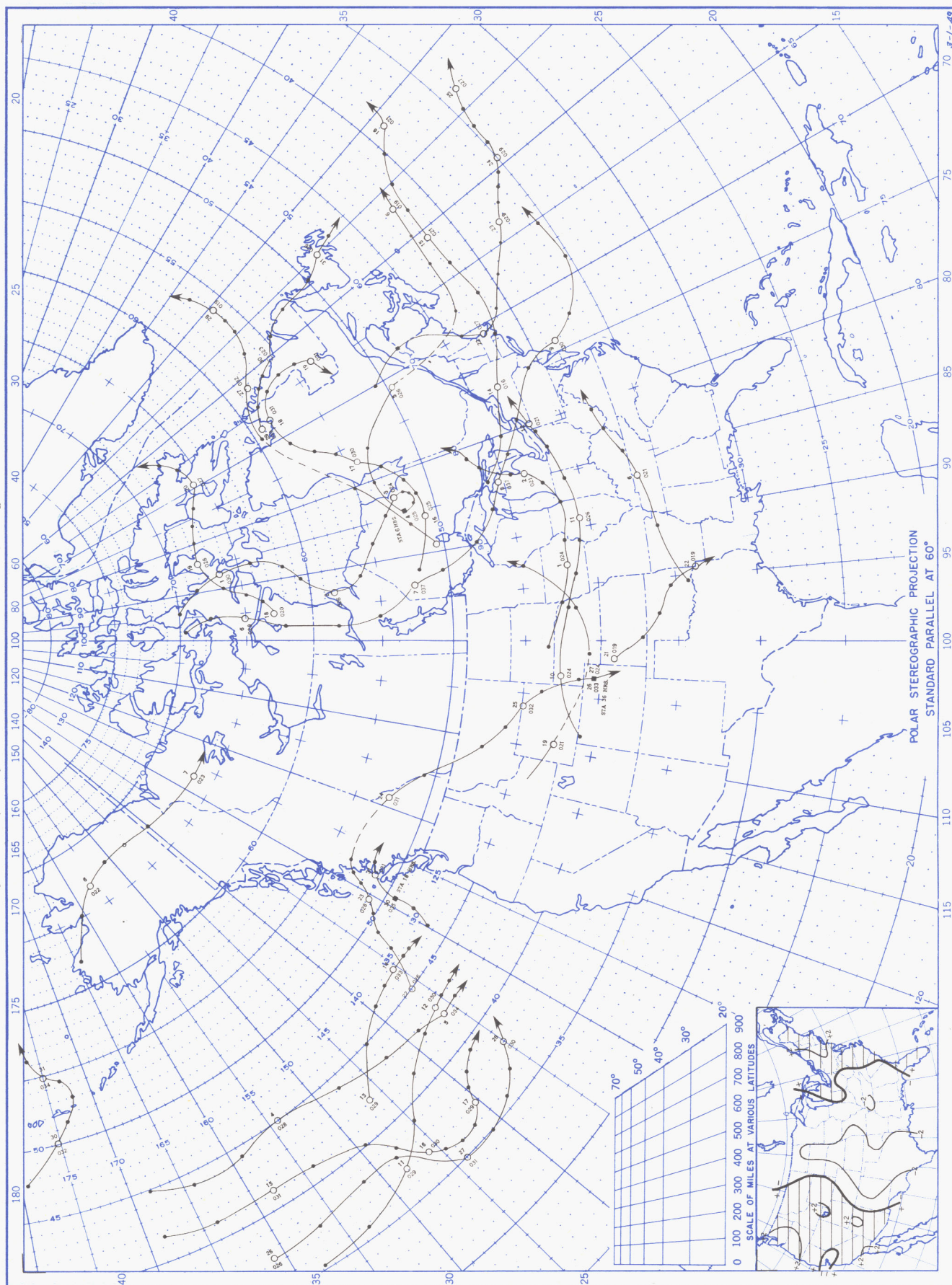




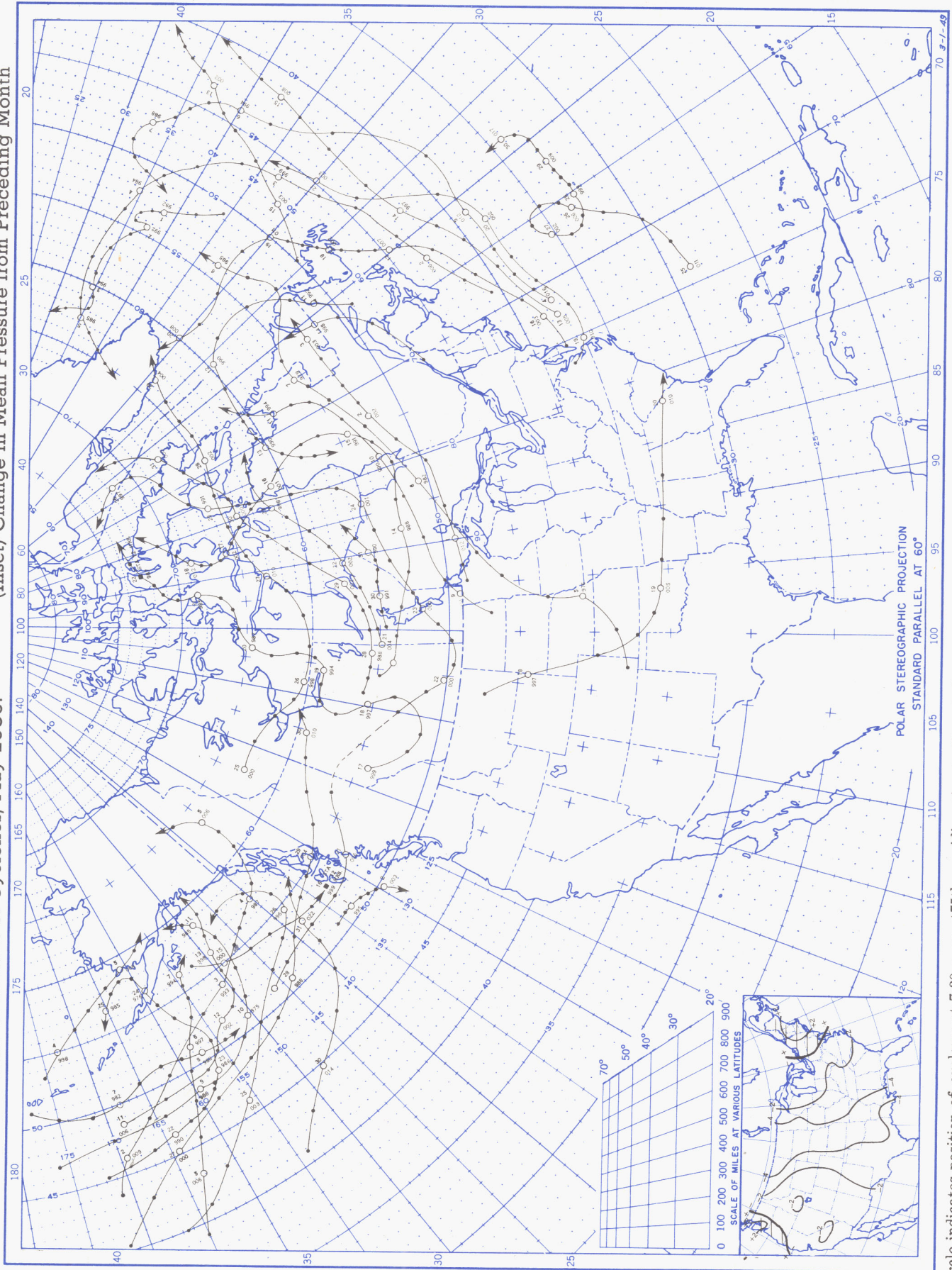
Chart II. Tracks of Centers of Anticyclones, May 1950. (Inset) Departure of Monthly Mean Pressure from Normal



Circle indicates position of anticyclone at 7:30 a. m. (75th meridian time). Dots indicate intervening 6-hourly positions. Figure above circle indicates date, and figure below, pressure to nearest millibar. Only those centers which could be identified for 24 hours or more are included.



Chart III. Tracks of Centers of Cyclones, May 1950. (Inset) Change in Mean Pressure from Preceding Month



Circle indicates position of cyclone at 7:30 a. m. (75th meridian time) Dots indicate intervening 6-hourly positions. Figure above circle indicates date, and figure below, pressure to nearest millibar. Only those centers which could be identified for 24 hours or more are included.



Chart IV. Percentage of Clear Sky Between Sunrise and Sunset, May 1950

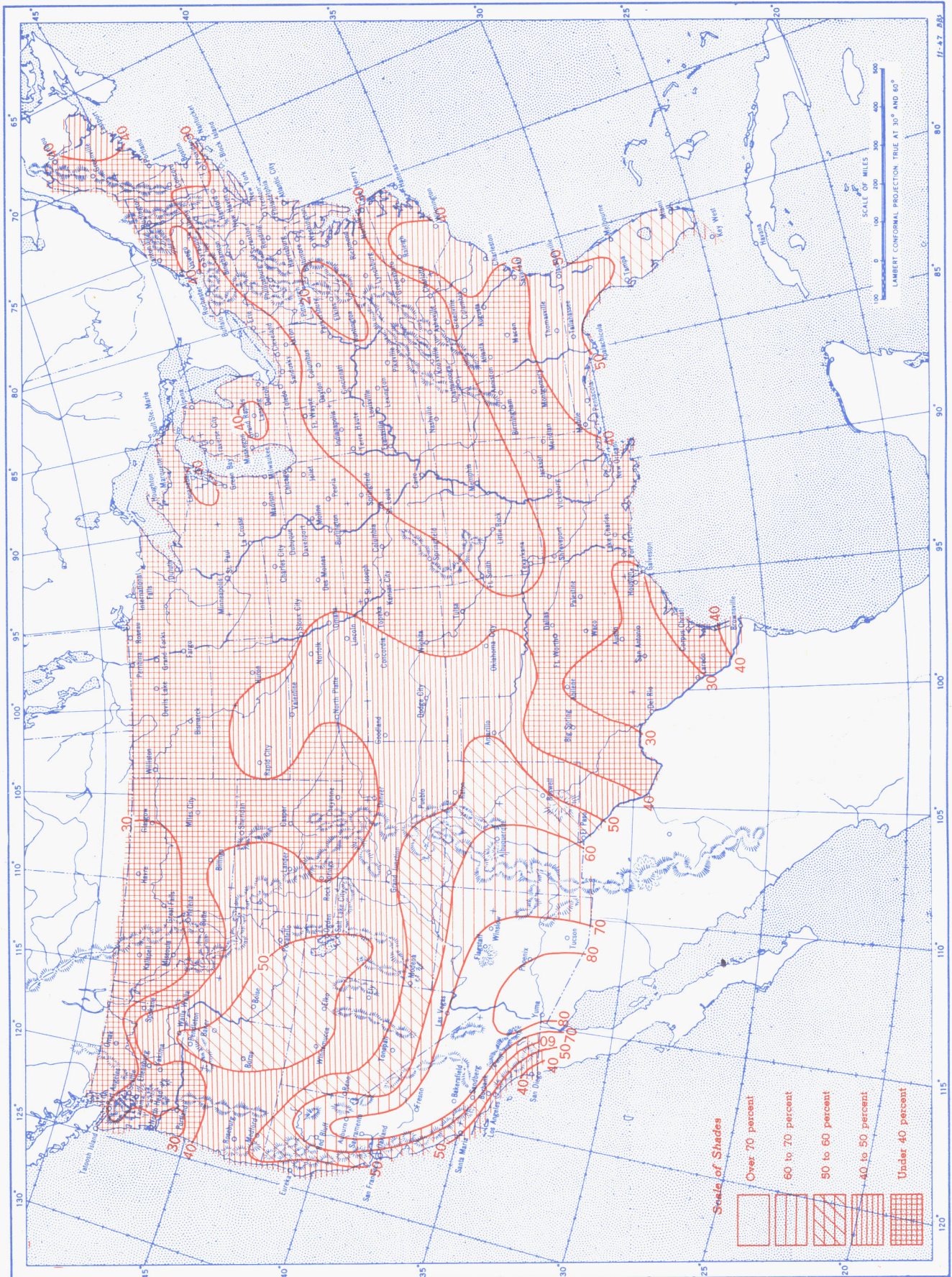




Chart V. Total Precipitation, Inches, May 1950. (Inset) Departure of Precipitation from Normal

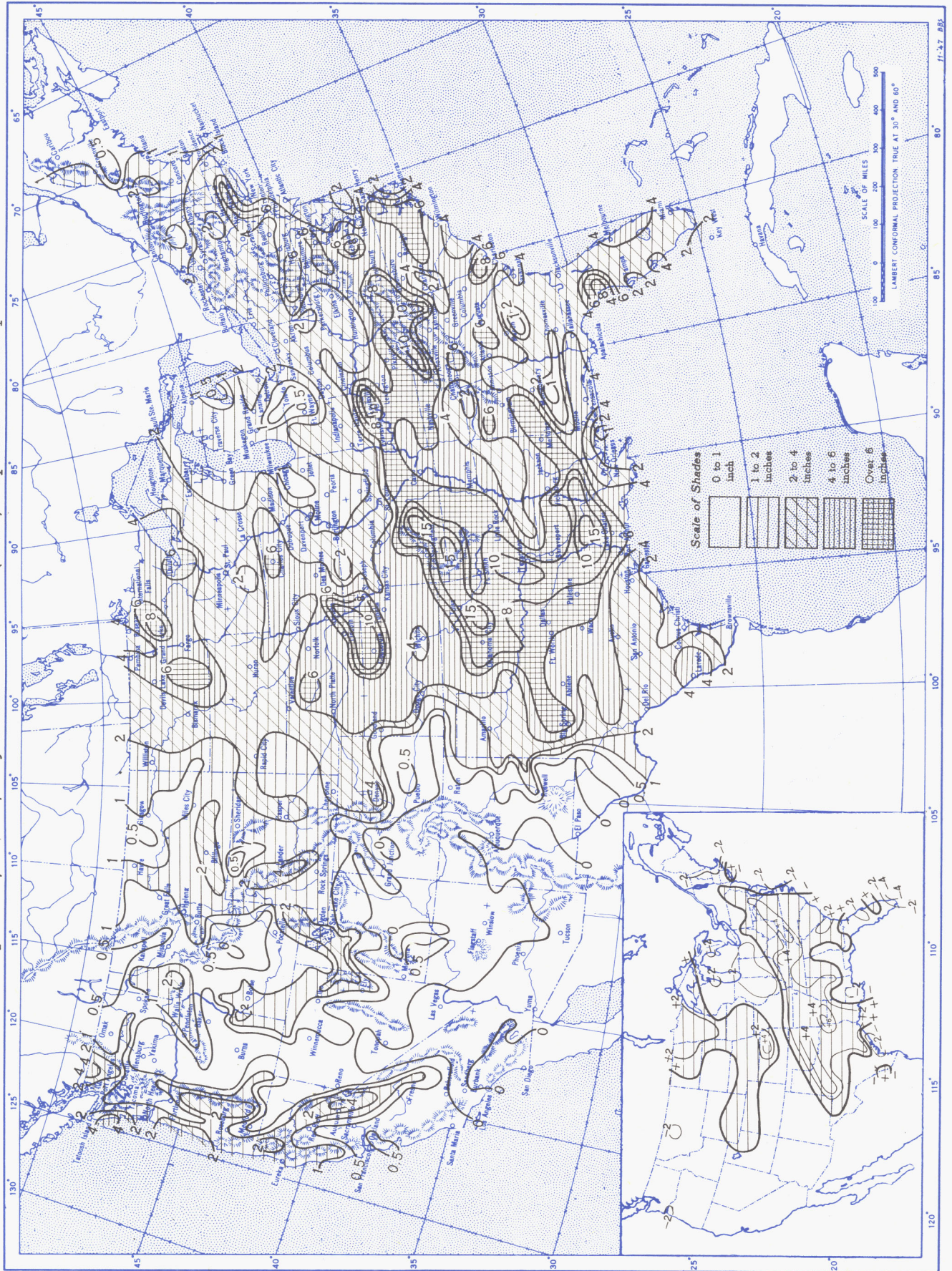
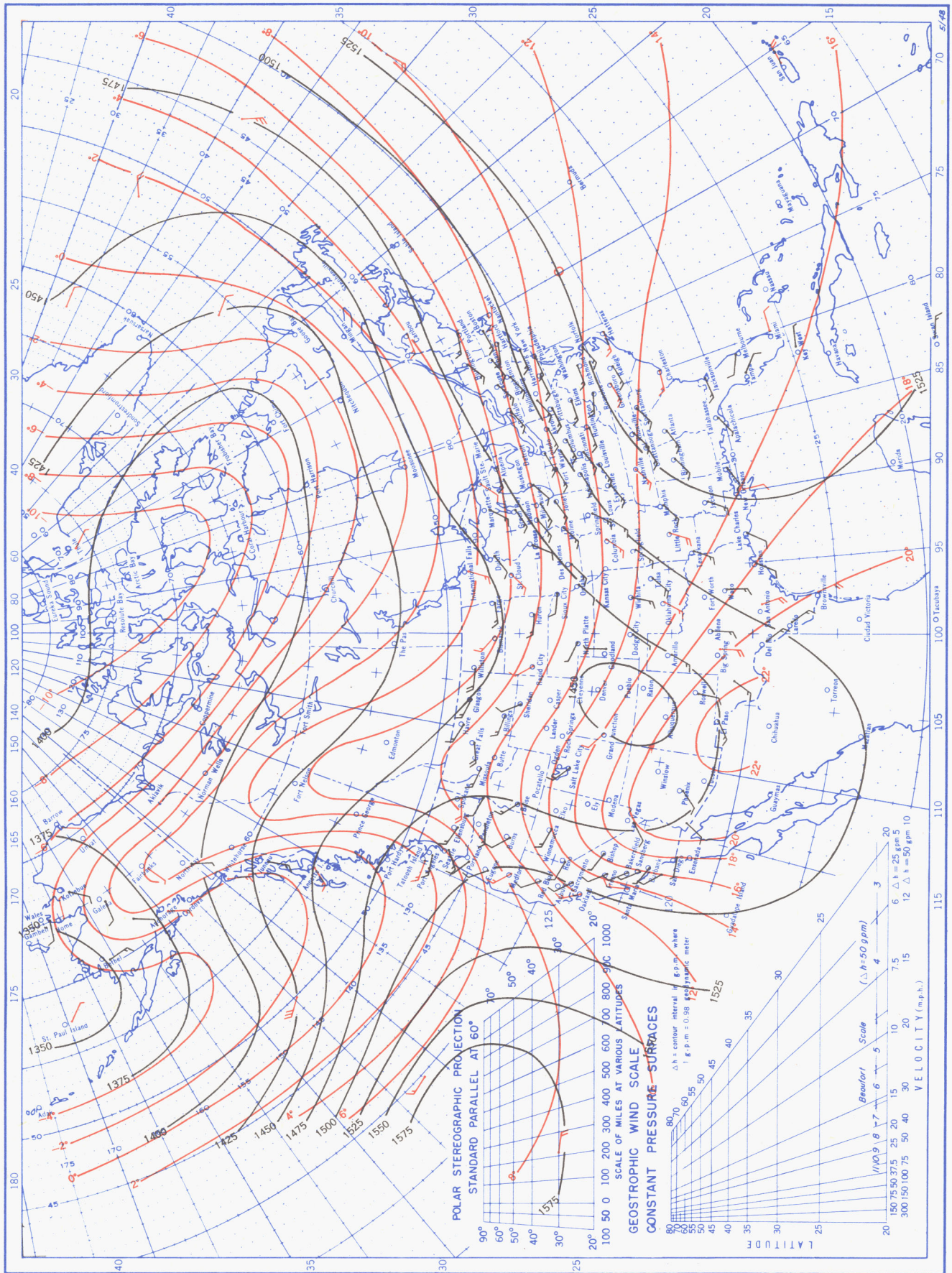




Chart VI. Mean Isobars (mb.) at Sea Level and Mean Isotherms ( $^{\circ}$ F.) at Surface, May 1950



Chart VIII, May 1950. Contour Lines of Mean Dynamic Height (Geopotential) in Units of 0.98 Dynamic Meters and Mean Isotherms in Degrees Centigrade for the 850-millibar Pressure Surface, and Resultant Winds at 1,500 Meters (m. s. l.)



Contour lines and isotherms based on radiosonde observations at 0300 G. C. T. Winds indicated by black arrows based on pilot balloon observations at 2100 G. C. T.; those indicated by red arrows based on rawins taken at 0300 G. C. T.



Chart IX, May 1950. Contour Lines of Mean Dynamic Height (Geopotential) in Units of 0.98 Dynamic Meters and Mean Isotherms in Degrees Centigrade for the 700-millibar Pressure Surface, and Resultant Winds at 3,000 Meters (m. s. l.)

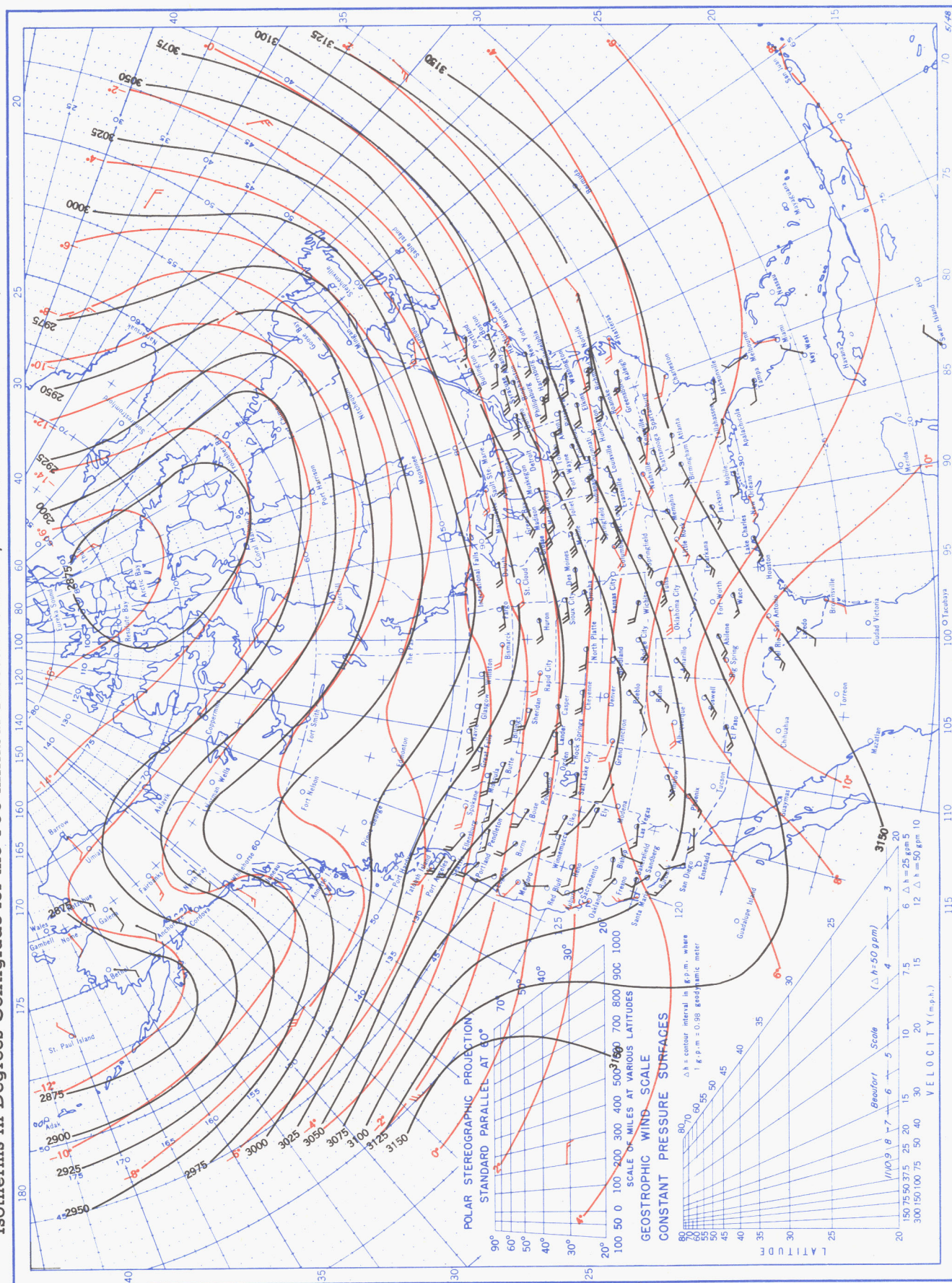
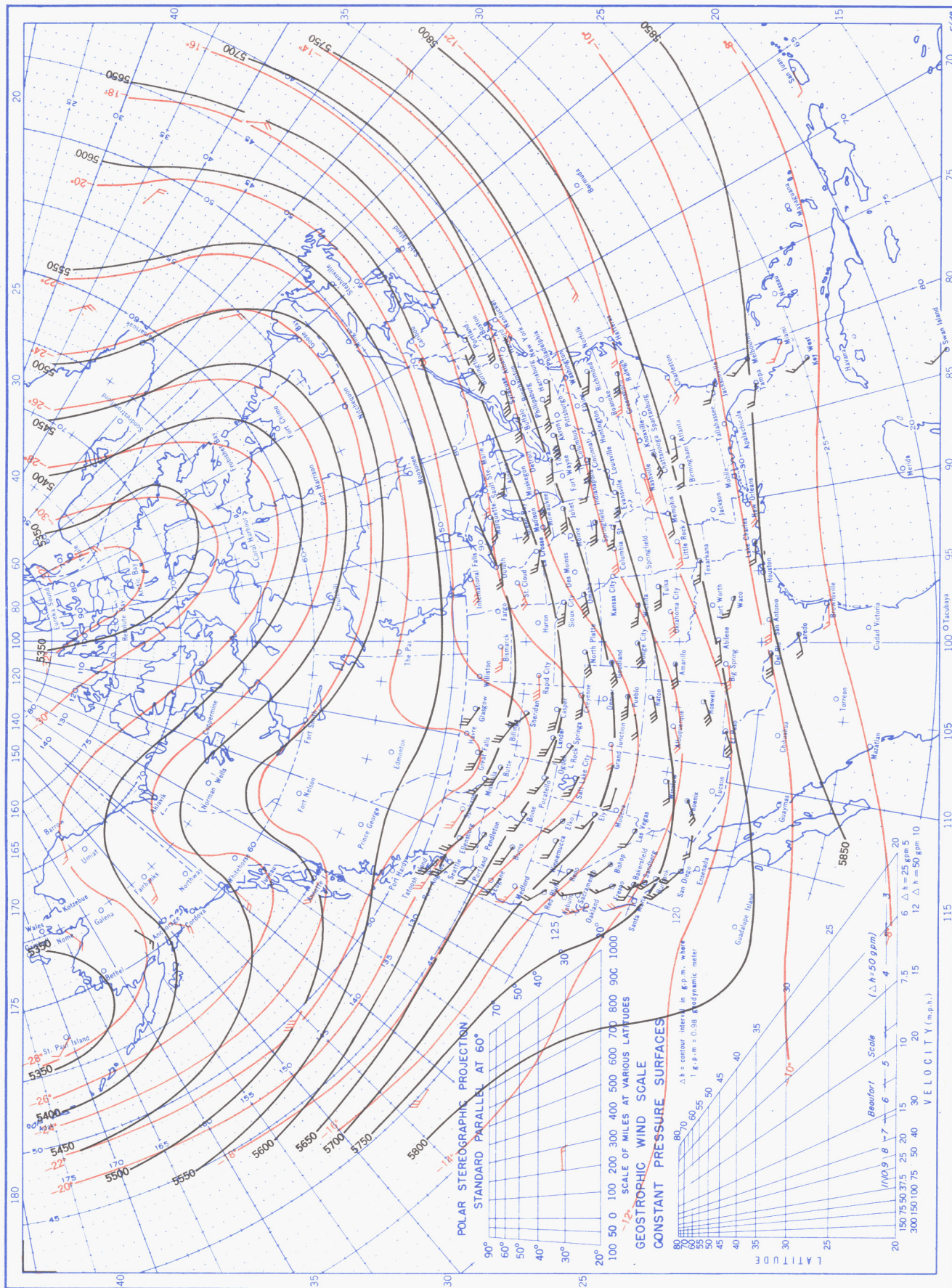




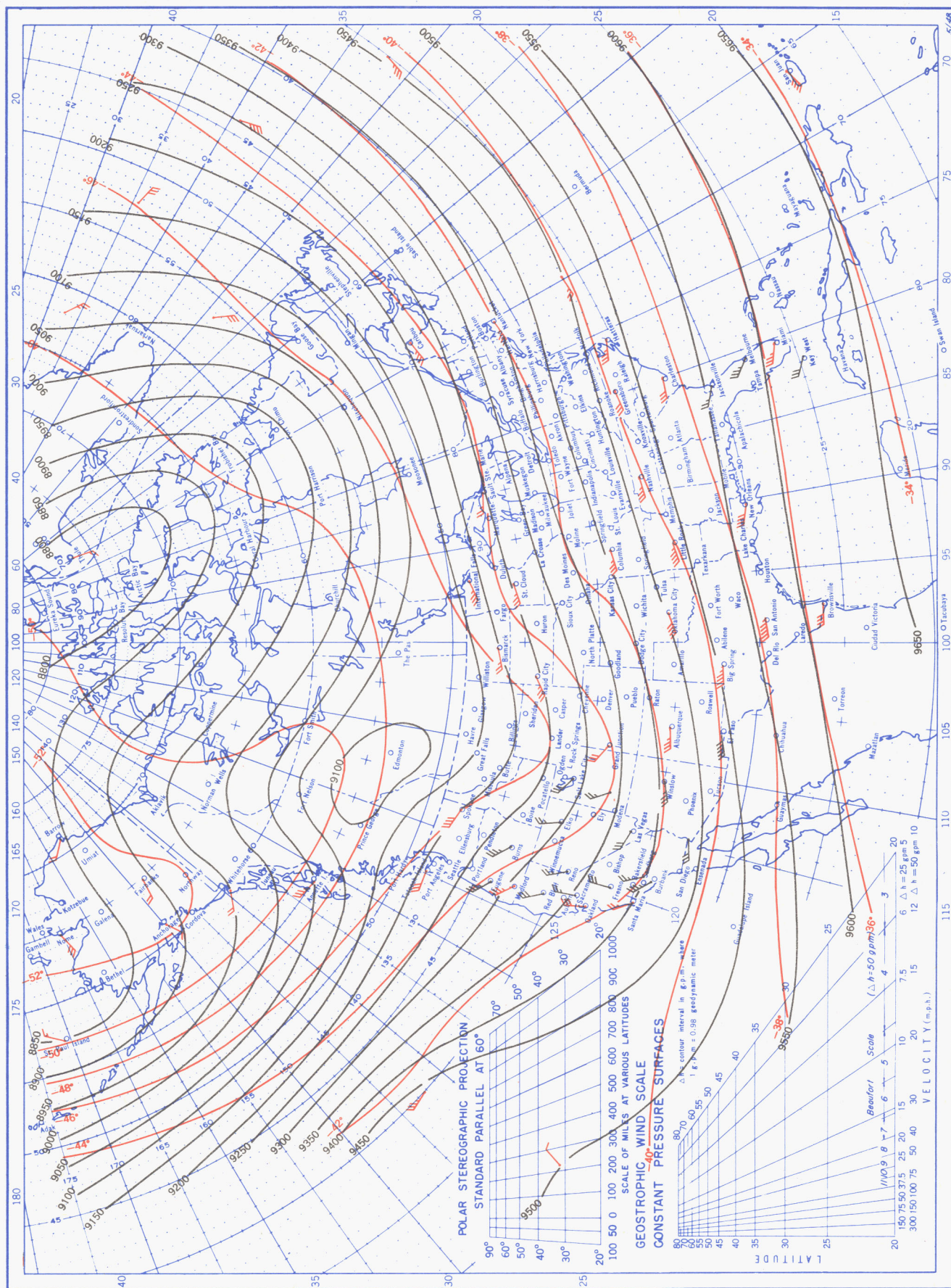
Chart X, May 1950. Contour Lines of Mean Dynamic Height (Geopotential) in Units of 0.98 Dynamic Meters and Mean Isotherms in Degrees Centigrade for the 500-millibar Pressure Surface, and Resultant Winds at 5,000 Meters (m. s. l.)



Contour lines and isotherms based on radiosonde observations at 0300 G. C. T. Winds indicated by black arrows based on pilot balloon observations at 2100 G. C. T.; those indicated by red arrows based on rawinsonde observations at 0800 G. C. T.



Chart XI, May 1950. Contour Lines of Mean Dynamic Height (Geopotential) in Units of 0.98 Dynamic Meters and Mean Isotherms in Degrees Centigrade for the 300-millibar Pressure Surface, and Resultant Winds at 10,000 Meters (m. s. l.)



Contour lines and isotherms based on radiosonde observations at 0300 G. C. T. Winds indicated by black arrows based on pilot balloon observations at 2100 G. C. T.; those indicated by red arrows based on rawins taken at 0800 G. C. T.